Southeast Alaska Coastal Monitoring Project

JC-03-05 June Cruise Report 12 August 2003

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Scientists from the Marine Salmon Investigations Program at Auke Bay Laboratory, Alaska Fisheries Science Center, National Marine Fisheries Service, conducted an eight-day cruise aboard the NOAA ship *John N. Cobb* in the marine waters of the northern region of southeastern Alaska, 21-25 and 28-30 June 2003. The original schedule for this Southeast Coastal Monitoring (SECM) program cruise, JC-03-05, was interrupted due to vessel mechanical problems. The data collected will provide improved temporal resolution on the abundance of juvenile salmon in Icy Strait and on size selectivity of two gear types for juvenile salmon during the period of transition from nearshore to offshore habitats.

Sampling in 2003 marks the seventh year of the SECM project, initiated in 1997 to study the habitat use and early marine ecology of juvenile Pacific salmon (*Oncorhynchus* spp.) in inshore, strait, and coastal habitats along the primary seaward migration corridor used by juvenile salmon. These habitats span 250 km from near Juneau westward through Icy Strait, the SECM index area, to 64 km offshore in the Gulf of Alaska. General objectives for the monitoring cruises are to: 1) collect biological data and stock-specific information on juvenile Pacific salmon (*Oncorhynchus* spp.) and other pelagic fish species from surface rope trawl samples; 2) monitor physical and biological oceanographic indices seasonally at sampling stations in inside, strait, and offshore habitats of juvenile salmon; and 3) conduct process studies focusing on bioenergetics of juvenile salmon.

METHODS

Oceanographic sampling:

The biophysical environment was monitored at each station and throughout the cruise. To examine horizontal water structure, temperature and salinity readings were continuously logged at one-minute intervals from 2-m depth using a SeaBird SBE-21[1] thermosalinograph. To examine vertical water structure, a Seabird SBE-19 conductivity-temperature-depth (CTD)

[1]Reference to trade names does not imply endorsement by the NOAA Fisheries.

profiler was deployed at each station to 200 m or within 10 m of the bottom, dependent on depth. Surface water samples were taken at each station for later determination of chlorophyll and nutrient content.

Zooplankton was sampled at each station with conical nets hauled vertically and a bongo net system towed obliquely. At each station, vertical plankton hauls were retrieved from a depth of 20 m using a 50-cm frame and 243 micron mesh (Norpac) net. A Roshiga flow meter was used inside the vertical net frames to determine the amount of water volume sampled. Also at each station, one "deep" double oblique bongo tow was done to 200 m or within 20 m of the bottom using a 60-cm frame with 505 and 333 micron mesh nets, and one "shallow" bongo tow was done to 20 m depth. General Oceanics flow meters were placed inside each of the bongo nets to determine the amount of water volume sampled. A Bendix/Marine Advisors Model T-1 Bathykymograph[1] time depth recorder was used with the bongo nets to validate the maximum deployment depth of each tow. During replicate trawls, only samples using the Norpac and shallow CTD were collected.

Trawl Sampling:

Sampling fish was done with two research nets. The project standard gear, a Nordic 264 rope trawl, was fished directly astern the NOAA ship *John N. Cobb* at the surface. The mouth opening of the trawl was approximately 20 m deep and 26 m wide, spread by a pair of 3.0-m Lite trawl doors. The trawl was fished fully open with 150 m of main warp out for a duration of 20 min at a speed of about 1.0-1.5 m/sec (2-3 knots). To fish the headrope of the trawl at the surface, a cluster of three, meshed A-4 Polyform buoys was tethered to each wing tip of the headrope and one A-3 Polyform float was clipped onto the center of the headrope. Mesh sizes ranged from 162.6 cm in the throat of the trawl near the jib lines to 8.9 cm in the cod end. A 6.1 m long, 0.8 cm knotless liner was sewn into the cod end. Along the jib lines on the top panel of the trawl, between the head rope and the first 162.6-cm mesh, a small mesh panel of 10.2-cm mesh was incorporated to minimize the loss of fish aft of the headrope.

Secondary fishing operations involved a two-boat trawl (townet) deployed and retrieved by the *John N. Cobb*, with assistance by the Auke Bay Laboratory vessel *RV Quest.* This trawl has a mouth opening of 3 m deep by 6 m wide and is held open by a pair of steel spreader bars having bottom weights and top floats. The net is fished for ten minutes with one towing bridle hooked to each vessel at a speed of 1.0 m/s (2 knots). The trawl mesh tapers to approximately 1.5 mm at the cod end.

After each haul, the fish caught were anaesthetized with tricaine methanesulfonate, identified, enumerated, measured, and stomachs sampled (if appropriate). Fish were measured to the nearest mm fork length (FL) with a Limnotera FMB IV electronic measuring board or metric ruler. All salmon were examined for lack of the adipose fin indicating the presence of a coded-wire tag (CWT) in the snout. Stomachs from potential predators of juvenile salmon were excised, weighed, and classified by fullness. The weight of the stomach contents was determined as the difference between the weight of the stomach and contents minus the weight of the empty stomach. Stomach contents were removed and prey were generally identified to the family level and estimated to the nearest 10% of total volume.

Laboratory processing:

Laboratory processing in progress includes 1) settled volumes (SVs) of zooplankton in the 20-m NORPAC vertical hauls, 2) measurement of weight and condition of juvenile salmon; 3) determination of energetic content from frozen samples of juvenile pink, chum, and coho salmon; 4) examination for otolith thermal marks in frozen samples of juvenile chum, sockeye, coho, and chinook salmon; 5) scale samples of each species of juvenile salmon; 6) measurement of plankton displacement volumes of all Bongo net samples; 7) zooplankton species composition and abundance from all Norpac hauls and from Bongo net samples taken in Icy Strait stations; 8) determination of energy density of zooplankton taxa from frozen samples using bomb calorimetry; and 9) changes in energy density of starved juvenile pink and chum salmon held over time in experimental tanks.

RESULTS and DISCUSSION

Thirteen stations were sampled on cruise JC–03-05 during late-June 2003 (Table 1, Figure 1). Oceanographic measurements and rope trawl samples and replicates were completed at all stations except IPA (due to porpoise activity) and UCB, UCC, and UCD (due to time limitations imposed by vessel mechanical problems); in addition, a nocturnal trawl haul was conducted at ISD and one nocturnal townet haul was conducted at each station in Icy Strait using the RV *Quest*. Standard oceanographic sampling and surface trawling were conducted according to the following schedule at 13 stations (Table 1):

Day 1: ABM zooplankton and oceanographic samples, transit to Icy Point;

Day 2: Icy Point zooplankton and oceanographic samples, 2 surface trawls;

Day 3: Icy Strait zooplankton and oceanographic samples, 4 surface trawls;

Day 4: Chatham Strait zooplankton and oceanographic samples, 5 surface trawls;

Day 5: UCA replicate trawl, return to port due to mechanical failure;

Day 6: in port for repairs;

Day 7: in port for repairs;

Day 8: Icy Strait replicate trawls (4);

Day 9: Icy Strait nocturnal 2-boat trawls (4);

Day 10: ISD nocturnal surface trawl (1), return to port mid-day.

Oceanographic data collected during the cruise included 19 CTD casts, 13 water samples, and 68 zooplankton samples (Table 2). Shallow and deep bongo samples were collected at each station in Icy Strait and were preserved according to standard operating procedures; in addition, extra bongo samples were collected at IPA, ISC, UCC, and ABM and frozen for later

determination of energy densities of zooplankton prey taxa. One nocturnal bongo sample was collected and preserved for analysis of decapod larval stages for a cooperative study with a University of Alaska doctoral student.

Surface (2-m) temperatures ranged from 9.6 to 11.8°C and salinities ranged from 22.4 to 32.0 PSU. Temperatures at 2-m depth were approximately 2-3 degrees higher and salinities were 2-3 PSU lower (in inside waters) in the late-June cruise JC-03-05 compared to values from the same stations in late May during cruise JC-03-02.

Nearly 5700 fish were captured in 17 trawl hauls in late-June, 1873 of which (about 33%) were juvenile salmon. Juvenile salmon were captured in five out of six rope trawl hauls in Upper Chatham Strait and in eight out of nine trawl hauls in Icy Strait, but none were captured in the two trawls conducted at Icy Point transect (Tables 3, 4). The largest catches of juvenile salmon were made at UCA during daylight with the rope trawl (188 juvenile chum and 117 juvenile sockeye salmon), and at ISD shortly before midnight with the two-boat trawl (440 juvenile chum salmon, 900 juvenile pink salmon, and 55 juvenile sockeye salmon).

A total of 42 immature and adult salmon were captured with the rope trawl (16 chinook, 12 chum, 11 pink, and 3 coho salmon). No salmon lacked the adipose fin. Juvenile Walleye pollock and both larval pollock and larval Pacific herring were the only other prominent species caught (Table 3); the larvae were caught in both gear-types in the day and the night, while the juvenile pollock were caught with the surface trawl and principally at night at ISD (estimated 2001). Thus, daytime catches of juvenile salmon sometimes co-occurred with relatively small catches of juvenile pollock, but the nocturnal trawl did not catch juvenile salmon when large numbers of pollock were caught.

Several hundred juvenile pink and chum salmon from the nocturnal haul at ISD were transferred to a live tank for experiments to determine the rate of loss in whole body energy content over long-term starvation; these fish were later transferred to holding tanks at the Auke Bay Laboratory to continue the experiments. Samples of fish and crab larvae and several taxa of jellyfish were frozen for analysis of energy content in the laboratory by bomb calorimetry, data to be used in bioenergetic studies. On-board stomach analysis was completed on all immature and adult salmon and 32 juvenile pollock during the cruise. The presence and numbers of sea lice on juvenile and adult salmon was recorded. An average of 2.5 sea lice (range one-six per individual) were observed on one immature chinook, four adult chum, and eight adult pink salmon, but none were seen on juvenile salmon.

ACKNOWLEDGMENTS

We acknowledge and compliment the command and crew of the NOAA ship *John N. Cobb* for their cooperation and performance during the cruise.

Table 1.--Localities and coordinates of stations scheduled for oceanographic sampling in the marine waters of the northern region of southeastern Alaska using the NOAA ship *John N. Cobb*, 21-30 June 2003. Distance between stations within a transect is indicated in the "between km" column.

Locality	Station	Latitude North	Longitude West	Distance offshore km	Distance between km	Depth m
Auke Bay	ABM	58°22.00'N	134°40.00'W	1.5 km	--------	60 m
Upper	UCA	58°04.57'N	135°00.08'W	3.2 km	3.2 km	400 m
Chatham Strait	UCB	58°06.22'N	135°00.91'W	6.4 km	3.2 km	100 m
	UCC	58°07.95'N	135°01.69'W	6.4 km	3.2 km	100 m
	UCD	58°09.64'N	135°02.52'W	3.2 km	3.2 km	200 m
Icy Strait	ISA	58°13.25'N	135°31.76'W	3.2 km	3.2 km	128 m
	ISB	58°14.22'N	135°29.26'W	6.4 km	3.2 km	200m
	ISC	58°15.28'N	135°26.65'W	6.4 km	3.2 km	200 m
	ISD	58°16.38'N	135°23.98'W	3.2 km	3.2.km	234 m
Icy Point	IPA	58°20.12'N	137°31.76'W	6.9 km	16.8 km	160 m
	IPB	58°12.71'N	137°16.96'W	23.4 km	16.8 km	130 m
	IPC	58°05.28'N	137°26.75'W	40.2 km	16.8 km	150 m
	IPD	57°53.50'N	137°42.60'W	65.0 km	24.8 km	1300 m

Table 2.--Oceanographic and biological samples collected in the marine waters of the northern region of southeastern Alaska using the NOAA ship John N. Cobb, 21-30 June 2003. Abbreviations: R = rope trawl, TN = townet.

									No. of Zoopl. Samples			
Date	Station	Haul Number	Time	2-m Temp (^{0}C)	2-m Salinity (PSU)	Light Level (W/m^2)	CTD Depth (m)	Nutr. and Chlorophyll Samples	Norpac	Bongo	WP2	Trawl Type
21-Jun	ABM	7038	10:14	11.4	22.4	190	50	1	3	4	1	none
22-Jun	IPD	7039	7:30	11.7	32.0	81	200	1	1	2	1	none
22-Jun	IPC	7040	10:00	11.3	31.3	128	119	1	1	2	1	none
22-Jun	IPB	7041	11:45	11	31.5	283	111	1	1	2	1	R
22-Jun	IPB	7042	14:00	10.9	31.5	385	50	0	1	0	0	R
23-Jun	IPA	7043	16:10	9.7	31.7	440	155	1	1	4	1	none
23-Jun	ISA	7044	7:20	11.1	30.0	122	78	1	1	4	1	R
23-Jun	ISB	7045	9:55	10.7	29.6	757	179	1	1	4	1	R
23-Jun	ISC	7046	12:20	9.6	30.3	321	200	1	1	6	1	R
23-Jun	ISD	7047	14:55	11.1	29.0	500	200	1	1	4	1	R
24-Jun	UCA	7048	7:30	11.6	28.6	41	200	1	1	0	0	R
24-Jun	UCB	7049	9:55	11.4	27.8	80	200	1	1	0	0	R
24-Jun	UCC	7050	11:45	11.1	27.0	162	140	1	1	4	0	R
24-Jun	UCD	7051	14:20	11.6	26.3	70	135	1	1	0	0	R
24-Jun	UCA	7052	16:00	11.7	29.6	62	0	0	0	0	0	R
25-Jun	UCA	7053	7:35	9.8	29.8	135	50	0	1	0	0	R
28-Jun	ISD	7054	14:50	11.4	28.3	603	50	0	1	0	0	R
28-Jun	ISC	7055	16:23	10.6	29.3	226	50	0	1	0	0	R
28-Jun	ISB	7056	18:00	11.4	28.5	146	50	0	1	0	0	R
28-Jun	ISA	7057	19:20	10.1	29.7	70	50	0	1	0	0	R
29-Jun	ISA	7058	21:35	10.5	30.0	0	0	0	0	0	0	TN
29-Jun	ISB	7059	22:10	11.2	29.4	0	0	0	0	0	0	TN
29-Jun	ISC	7060	22:50	11.1	28.1	0	0	0	0	0	0	TN
29-Jun	ISD	7061	23:20	11.8	25.4	0	0	0	0	0	0	TN
30-Jun	ISD	7062	1:30	11.4	26.4	0.1	0	0	0	2	0	R
			average	11.0	28.9	192.1	**Total** 19	13	21	38	9	

Table 3.--Rope trawl and two-boat trawl (latter denoted by asterisk) catches at stations sampled in the marine waters of the northern region of southeastern Alaska using the NOAA ship *John N. Cobb* and Auke Bay Laboratory's *RV Quest,* 21-28 June 2003. Dashes indicate no trawling was conducted at the station.

			Juvenile salmon					Immature/adult				Non-salmonids													
Date	Station	Haul number	Chum	Pink	Coho	Chinook	Sockeye	Chinook (Imm.)	Chum (adult)	Pink (adult)	Coho (adult)	Crstd. sculpin	Herring	Herring (larvae)	Lingcod	Prowfish	Silver-spot sculpin	Smooth lumpsucker	Soft sculpin	Spiny dogfish	Squid	Pollock	Pollock (larvae)	Wolf-eel	TOTAL CATCH
22-Jun	ABM	7038	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
22-Jun	IPD	7039	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
22-Jun	IPC	7040	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
22-Jun	IPB	7041	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	3
22-Jun	IPB	7042	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4
22-Jun	IPA	7043	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
23-Jun	ISA	7044	10	2	0	0	2	1	0	0	0	0	0	78	0	0	0	0	0	0	0	0	0	0	93
23-Jun	ISB	7045	19	1	2	0	5	1	0	0	2	0	0	0	0	0	0	1	0	0	0	15	0	0	44
23-Jun	ISC	7046	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2
23-Jun	ISD	7047	2	1	2	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	6	0	0	15
24-Jun	UCA	7048	188	8	0	2	117	5	0	0	0	1	0	41	0	3	0	0	0	0	0	16	15	0	396
24-Jun	UCB	7049	10	3	0	0	5	3	1	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	25
24-Jun	UCC	7050	23	0	0	0	15	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40
24-Jun	UCD	7051	19	11	0	0	11	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	43
24-Jun	UCA	7052	1	0	0	0	2	3	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
25-Jun	UCA	7053	0	0	0	0	0	0	5	3	1	0	0	1	0	1	0	0	0	0	0	0	2	0	13
28-Jun	ISD	7054	1	1	0	0	3	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	13	0	20
28-Jun	ISC	7055	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2
28-Jun	ISB	7056	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	10	0	0	13
28-Jun	ISA	7057	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	3
29-Jun	ISA	7058*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	99	0	100
29-Jun	ISB	7059*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	48	0	50
29-Jun	ISC	7060*	3	1	0	0	0	0	0	0	0	0	0	1000	0	0	0	0	1	0	0	0	7	0	1012
29-Jun	ISD	7061*	440	900	4	0	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	400	0	1801
30-Jun	ISD	7062	0	0	0	0	0	0	4	2	0	0	0	0	0	0	0	0	0	0	1	2001	1	0	2008
TOTAL CATCH			718	928	8	2	217	16	12	13	3	3	2	1122	1	7	1	1	2	2	1	2051	586	2	5697

Table 5.--Length, frequency of occurrence in hauls (FO), percent frequency of occurrence (%FO), and life history stage of fish captured in 21 rope trawl hauls in the marine waters of the northern region of southeastern Alaska using the NOAA ship *John N. Cobb*, 22-29 July 2003. SD = standard deviation.

Trawl Type	Species	FO	%FO	Number measured	Minimum length (mm)	Minimum length (mm))	Mean length (mm)	SD length
				Juvenile Salmon				
Rope trawl	Pink	7	41.2	27	83	142	105.4	16.2
Rope trawl	Chum	12	70.6	276	88	137	116.3	9.6
Rope trawl	Sockeye	1	5.9	160	83	173	120.1	15.0
Rope trawl	Coho	2	11.8	4	144	190	172.8	20.0
Rope trawl	Chinook	1	5.9	2	162	176	169.0	9.9
Townet	Pink	2	50.0	52	28	125	99.0	15.4
Townet	Chum	1	25.0	254	73	143	104.9	14.0
Townet	Sockeye	1	25.0	54	77	173	109.4	15.5
Townet	Coho	1	25.0	5	141	195	174.8	23.4
				Adult/Immature Salmon				
Rope trawl	Pink	7	41.2	13	485	590	538.9	31.7
Rope trawl	Chum	5	29.4	12	595	691	636.1	34.0
Rope trawl	Coho	1	5.9	1	640	640	640.0	
Rope trawl	Chinook	7	41.2	16	265	389	315.1	32.3
				Non-salmonids				
Rope trawl	Crested sculpin	3	17.6					
Rope trawl	Herring	1	23.5	2	223	233	228.0	7.1
Rope trawl	Lingcod	1	5.9	1	35	35	35.0	
Rope trawl	Pacific Sandfish	1	5.9					
Rope trawl	Prowfish	4	23.5	1	45	45	45.0	
Rope trawl	Smooth lumpsucker	1	5.9	5	43	47	45.2	1.8
Rope trawl	Soft sculpin	1	5.9	1	185	185	185.0	
Rope trawl	Spiny dogfish	1	5.9	1	25	25	25.0	
Rope trawl	Squid	1	5.9	2	655	688	671.5	23.3
Rope trawl	Walleye pollock	6	35.3	33	281	353	316.6	17.8
Rope trawl	Walleye pollock larvae	5	29.4	15	24	46	37.1	4.8
Rope trawl	Wolf-eel	1	5.9	3	239	470	368.0	117.8
Townet	Herring larvae	2	50.0	20	28	41	32.2	3.6
Townet	Walleye pollock larvae	4	100.0	15	20	42	31.9	6.6
Townet	Prowfish	1	25.0					11.0
Townet	Soft sculpin	1	25.0					14.0
Townet	Silver-spot sculpin	1	25.0					9.0
Townet	Walleye pollock	1	25.0					22.0

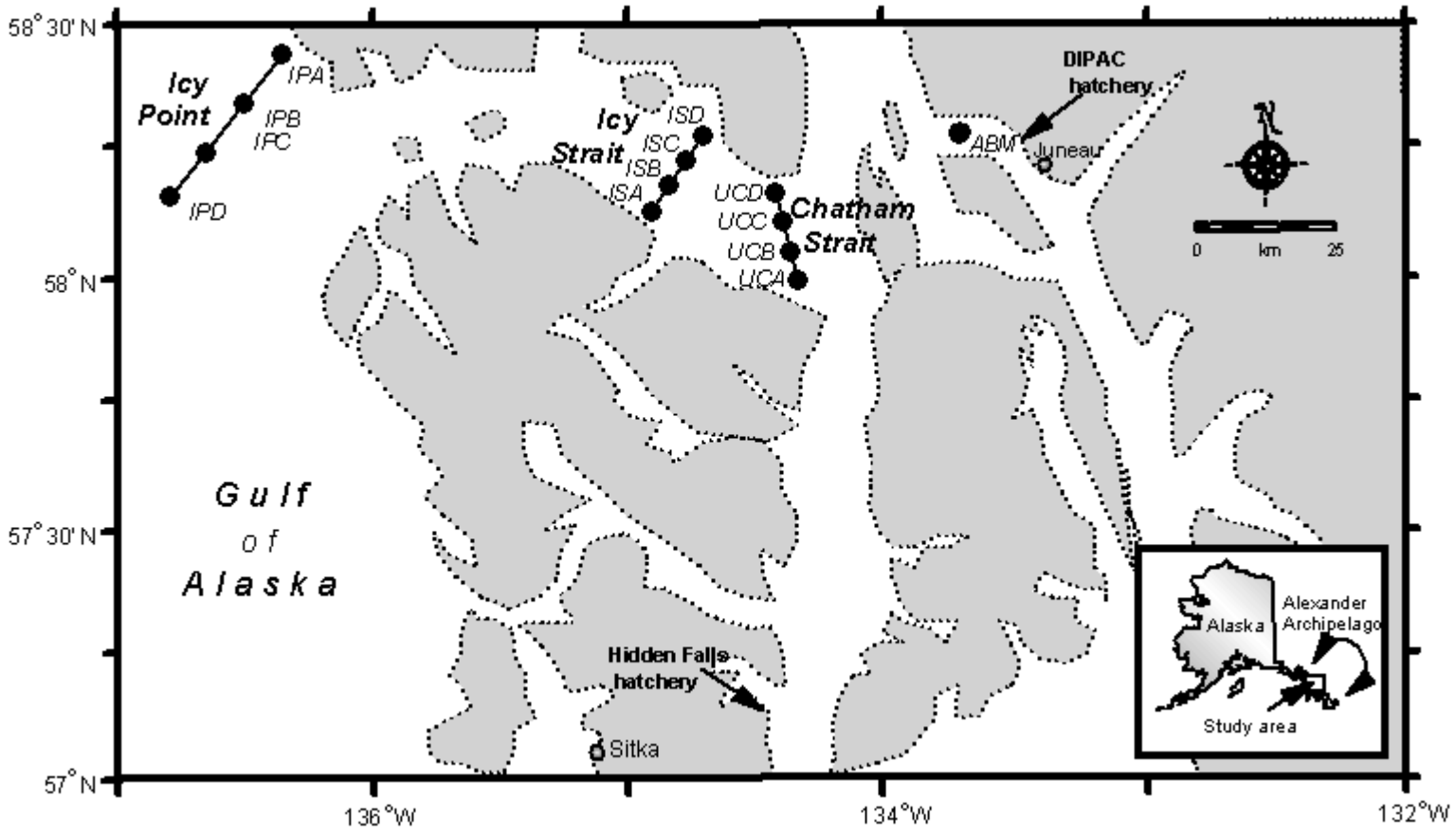

Figure 1.–Locations of Icy Strait stations sampled from the NOAA ship *John N. Cobb* and RV Quest, 21-30 June 2003.